1. A thermoacoustic device having an operating mode and a non-operating mode, the device comprising:

a housing;

a thermal core supported in the housing and having a first and a second surface, the thermal core including a first heat exchanger defining the first surface of the thermal core and a second heat exchanger defining the second surface of the thermal core;

a main chamber in fluid communication with the first surface of the thermal core;

a secondary multiplier chamber in fluid communication with the second surface of the thermal core;

a working volume of a gaseous working fluid filling the main chamber, the multiplier chamber, and the thermal core at a pressure, an equilibrium pressure being defined as the pressure of the working volume of gaseous working fluid when the thermoacoustic device is in the non-operating mode;

the main chamber including a first oscillating member, the first oscillating member being operable when the thermoacoustic device is in the operating mode to oscillate such that pressure in the multiplier chamber is oscillated between a peak pressure greater than the equilibrium pressure and a minimum pressure less than the equilibrium pressure, a main pressure amplitude being defined as one half of the difference between the peak pressure and the minimum pressure in the main chamber;

the secondary multiplier chamber including a second oscillating member, the second oscillating member being operable when the thermoacoustic device is in the operating mode to oscillate such that the pressure in the multiplier chamber is oscillated between a peak pressure greater than the equilibrium pressure and a minimum pressure less than the equilibrium pressure, a multiplier pressure amplitude being defined as one half of the difference between the peak pressure and the minimum pressure in the multiplier chamber;

wherein the first and second oscillating members oscillate at substantially the same frequency and such that the pressure oscillations in the main chamber and the multiplier chamber are substantially in phase with each other; and

the multiplier pressure amplitude is greater than the main pressure amplitude.

2. The thermoacoustic device according to claim 1, wherein the multiplier pressure amplitude is at least 2% greater than the main pressure amplitude.

3. The thermoacoustic device according to claim 1, wherein the multiplier pressure amplitude is at least 4% greater than the main pressure amplitude.

4. The thermoacoustic device according to claim 1, wherein the multiplier pressure amplitude is at least 6% greater than the main pressure amplitude.

5. The thermoacoustic device according to claim 1, further comprising a motor connected to the first oscillating member, the motor being operable to sinusoidally oscillate the first oscillating member such that the thermoacoustic device operates as a heat pump.

6. The thermoacoustic device according to claim 1, further comprising an alternator connected to the first oscillating member, the thermoacoustic device operating as a heat driven engine.

7. The thermoacoustic device according to claim 1, wherein the multiplier chamber is disposed within the main chamber.

8. The thermoacoustic device according to claim 7, wherein:

the first heat exchanger comprises a hot heat exchanger;

the second heat exchanger comprises cold head heat exchanger which forms one end of the housing, the cold head heat exchanger having an exterior heat exchange surface in thermal communication with an interior heat exchange surface;

the thermoacoustic device further comprising;

a support disposed in the housing adjacent the interior heat exchange surface of the cold head heat exchanger, the support defining a first passage between the multiplier volume and the interior heat exchange surface of the cold head heat exchanger and a second passage between the main volume and the interior heat exchange surface of

the cold head heat exchanger, whereby the main volume and the multiplier volume are in fluid communication through the first and second passages;

a porous thermal storage element disposed in the first passage, the thermal storage element having a first surface and a second surface, the first surface being adjacent the interior heat exchange surface of the cold head heat exchanger and the hot heat exchanger being disposed adjacent the second surface of the thermal storage element.

9. The thermoacoustic device according to claim 1, wherein the first oscillating member comprises a piston, the main chamber including a flexure seal having a pair of ends and a flexure body extending therebetween, one end of the flexure seal being sealed to the piston and the other end being sealed to the first surface of the thermal core.

10. The thermoacoustic device according to claim 9, wherein the flexure seal comprises a bellows.

11. The thermoacoustic device according to claim 1, wherein the main chamber has a perimeter side wall and the oscillating member comprises a piston with a perimeter edge that slidably engages the side wall.

12. The thermoacoustic device according to claim 1, wherein the multiplier chamber has a perimeter side wall with a edge spaced from the second surface of the thermal core, the second oscillating member comprising a piston interconnected with the edge by a flexible seal.

13. The thermoacoustic device according to claim 1, wherein the second oscillating member comprises a piston, the multiplier chamber including a flexure seal having a pair of ends and a flexure body extending therebetween, one end of the flexure

seal being sealed to the piston and the other end being sealed to the second surface of the thermal core.

14. The thermoacoustic device according to claim 1, wherein the first and second oscillating members are interconnected such that their displacements are identical.

15. The thermoacoustic device according to claim 14, wherein the first and second oscillating members are integrally formed.

16. The thermoacoustic device according to claim 1, wherein the housing comprises a pressure vessel, the main chamber and multiplier chamber being disposed in the pressure vessel, an additional volume of gaseous working fluid filling the pressure vessel.

17. The thermoacoustic device according to claim 1, further comprising a thermal storage element disposed between the first and second heat exchangers.

18. The thermoacoustic device according to claim 1, wherein;

the first heat exchanger comprises a plurality of generally parallel heat transfer elements disposed generally in a first plane and generally aligned in a first direction;

the second heat exchanger comprises a second plurality of generally parallel heat transfer element disposed in a second plane and generally aligned in a second direction, the second plane being generally parallel to the first plane and the second direction being at an angle to the first direction.

19. The thermoacoustic device according to claim 18, wherein the heat transfer elements of the first heat exchanger are fins and the heat transfer elements of the second heat exchanger are fluid filled tubes.

20. The thermoacoustic device according to claim 18, wherein the first and second directions are generally perpendicular.

21. A thermoacoustic device comprising:

a power piston;

a motor operable to oscillate the power piston;

a cold head heat exchanger spaced from the power piston;

a flexure seal having a pair of ends and a flexure body extending therebetween, one of the ends being sealingly interconnected with the power piston and the other end being sealing interconnected with the cold head, a main volume being defined within the flexure seal between the power piston and the cold head;

a multiplier chamber disposed inside the main volume, the chamber having a first end sealingly interconnected with the cold head and an open second end;

a multiplier piston being disposed so as to close the open end of the multiplier chamber, a multiplier volume being defined within the multiplier chamber between the multiplier piston and the cold head;

the cold head defining a passage between the main volume and the multiplier volume;

a porous thermal storage element disposed in the passage, the thermal storage element having a first and a second side; and

first and second heat exchangers, the first heat exchanger being disposed adjacent the first side of the thermal storage element and the second heat exchanger being disposed adjacent the second side of the thermal storage element.

22. A thermoacoustic device comprising:

a housing having a first end and a second end;

a cold head heat exchanger defining the first end of the housing, the cold head heat exchanger having an exterior heat exchange surface in thermal communication with an interior heat exchange surface;

a multiplier chamber disposed in the housing and having a multiplier volume defined therein, the multiplier chamber including a multiplier oscillating member, the

multiplier oscillating member being movable such that the multiplier volume is increased and decreased;

a main chamber disposed in the housing and surrounding the multiplier chamber, the main chamber having a main volume defined between the multiplier chamber and the main chamber, the main chamber including a main oscillating member, the main oscillating member being movable such that the main volume is increased and decreased;

a support disposed in the housing adjacent the interior heat exchange surface of the cold head heat exchanger, the support defining a first passage between the multiplier volume and the interior heat exchange surface of the cold head heat exchanger and a second passage between the main volume and the interior heat exchange surface of the cold head heat exchanger, whereby the main volume and the multiplier volume are in fluid communication through the first and second passages;

a porous thermal storage element disposed in one of the passages, the thermal storage element having a first surface and a second surface, the first surface being adjacent the interior heat exchange surface of the cold head heat exchanger; and

a hot heat exchanger disposed adjacent the second surface of the thermal storage element.

23. The thermoacoustic device according to claim 22, further comprising a motor connected to the main oscillating member, the motor being operable to oscillate the main oscillating member such that the thermoacoustic device operates as a heat pump.

24. The thermoacoustic device according to claim 22, further comprising an alternator connected to the main oscillating member, the thermoacoustic device operating as a heat driven engine.

25. The thermoacoustic device according to claim 22, wherein the main oscillating member comprises a piston, the main chamber including a flexure seal having a pair of ends and a flexure body extending therebetween, one end of the flexure seal being sealed to the piston and the other end being in fluid communication with the second passage.

26. The thermoacoustic device according to claim 25, wherein the flexure seal comprises a bellows.

27. The thermoacoustic device according to claim 22, wherein the main chamber has a perimeter side wall and the main oscillating member comprises a piston with a perimeter edge that slidably engages the side wall.

28. The thermoacoustic device according to claim 22, wherein the multiplier chamber has a perimeter side wall with a edge spaced from the first passage, the multiplier oscillating member comprising a piston interconnected with the edge by a flexible seal.

29. The thermoacoustic device according to claim 22, wherein the multiplier oscillating member comprises a piston, the multiplier chamber including a flexure seal having a pair of ends and a flexure body extending therebetween, one end of the flexure seal being sealed to the piston and the other end being in fluid communication with the first passage.

30. The thermoacoustic device according to claim 22, wherein the main and multiplier oscillating members are interconnected such that their displacements are identical.

31. The thermoacoustic device according to claim 30, wherein the main and multiplier oscillating members are integrally formed.

32. The thermoacoustic device according to claim 30, wherein the housing comprises a pressure vessel, the main chamber and multiplier chamber being disposed in the pressure vessel, an additional volume of gaseous working fluid filling a portion of the pressure vessel outside the main chamber and multiplier chamber.

33. The thermoacoustic device according to claim 22, wherein the thermal storage element is disposed in the first passage.

34. The thermoacoustic device according to claim 22, wherein the interior heat exchange surface includes fins extending perpendicularly from the cold head heat exchanger.

35. The thermoacoustic device according to claim 34, wherein the exterior heat exchange surface includes fins extending perpendicularly from the cold head heat exchanger, the fins on the interior surface and the fins on the exterior surface being generally perpendicular to each other.

36. A thermoacoustics device comprising:

a housing having a first end and a second end;

a cold head heat exchanger defining the first end of the housing, the cold head heat exchanger having an exterior heat exchange surface in thermal communication with an interior heat exchange surface;

a multiplier chamber disposed in the housing and having a multiplier volume defined therein, the multiplier volume including a multiplier oscillating member, the multiplier oscillating member being movable such that the multiplier volume is increased and decreased

a main chamber disposed in the housing and having a main volume defined therein, the main chamber including a main oscillating member, the main oscillating member being movable such that the main volume is increased and decreased;

a support disposed in the housing adjacent the interior heat exchange surface of the cold head heat exchanger, the support defining a first passage between the multiplier volume and the interior heat exchange surface of the cold head heat exchanger and a second passage between the main volume and the interior heat exchange surface of the cold head heat exchanger, whereby the main volume and the multiplier volume are in fluid communication through the first and second passages;

a porous thermal storage element disposed in one of the passages, the thermal storage element having a first surface and a second surface, the first surface being adjacent the interior heat exchange surface of the cold head heat exchanger; and

a hot heat exchanger disposed adjacent the second surface of the thermal storage element.

37. The thermoacoustic device according to claim 22, further comprising a motor connected to the main oscillating member, the motor being operable to oscillate the main oscillating member such that the thermoacoustic device operates as a heat pump.

38. The thermoacoustic device according to claim 22, further comprising an alternator connected to the main oscillating member, the thermoacoustic device operating as a heat driven engine.

39. The thermoacoustic device according to claim 22, wherein the main oscillating member comprises a piston, the main chamber including a flexure seal having a pair of ends and a flexure body extending therebetween, one end of the flexure seal being sealed to the piston and the other end being in fluid communication with the second passage.

40. The thermoacoustic device according to claim 39, wherein the flexure seal comprises a bellows.

41. The thermoacoustic device according to claim 22, wherein the main chamber has a perimeter side wall and the main oscillating member comprises a piston with a perimeter edge that slidably engages the side wall.

42. The thermoacoustic device according to claim 22, wherein the multiplier chamber has a perimeter side wall with a edge spaced from the first passage, the multiplier oscillating member comprising a piston interconnected with the edge by a flexible seal.

43. The thermoacoustic device according to claim 22, wherein the multiplier oscillating member comprises a piston, the multiplier chamber including a flexure seal having a pair of ends and a flexure body extending therebetween, one end of the flexure seal being sealed to the piston and the other end being in fluid communication with the first passage.

44. The thermoacoustic device according to claim 22, wherein the main and multiplier oscillating members are interconnected such that their displacements are identical.

45. The thermoacoustic device according to claim 44, wherein the main and multiplier oscillating members are integrally formed.

46. The thermoacoustic device according to claim 22, wherein the housing comprises a pressure vessel, the main chamber and multiplier chamber being disposed in the pressure vessel, an additional volume of gaseous working fluid filling a portion of the pressure vessel outside the main chamber and multiplier chamber.

47. The thermoacoustic device according to claim 22, wherein the thermal storage element is disposed in the first passage.

48. The thermoacoustic device according to claim 22, wherein the interior heat exchange surface includes fins extending perpendicularly from the cold head heat exchanger.

49. The thermoacoustic device according to claim 48, wherein the exterior heat exchange surface includes fins extending perpendicularly from the cold head heat exchanger, the fins on the interior surface and the fins on the exterior surface being generally perpendicular to each other.

50. A thermoacoustic device of the type having:

a chamber with a working volume of gaseous working fluid disposed therein;

an oscillating member forming part of the chamber and being movable such that the volume in the chamber increases and decreases;

a thermal core being disposed in the chamber, the thermal core including a first heat exchanger and a second heat exchanger;

the improvement comprising:

the first heat exchanger having a plurality of generally parallel heat transfer elements disposed generally in a first plane and generally aligned in a first direction; and

the second heat exchanger having a second plurality of generally parallel heat transfer elements disposed in a second plane and generally aligned in a second direction;

wherein the second plane is generally parallel to the first plane and the second direction is at an angle to the first direction.

51. The thermoacoustic device according to claim 50, wherein the first and second directions are generally perpendicular to each other.

52. The thermoacoustic device according to claim 50, wherein the heat transfer elements of the first heat exchanger are fins and the heat transfer elements of the second heat exchanger are fluid filled tubes.

53. The thermoacoustic device according to claim 50, wherein the heat transfer elements of the first heat exchanger and the heat transfer elements of the second heat exchanger are fluid filled tubes.

54. A thermoacoustic device having an operating mode and a non-operating mode, the device comprising:

a housing;

a thermal core supported in the housing and having a first and a second surface, the thermal core including a first heat exchanger defining the first surface of the thermal core and a second heat exchanger defining the second surface of the thermal core;

a main chamber in fluid communication with the first surface of the thermal core;

a secondary multiplier chamber in fluid communication with the second surface of the thermal core;

a working volume of a gaseous working fluid filling the main chamber, the multiplier chamber, and the thermal core at a pressure, an equilibrium pressure being defined as the pressure of the working volume of gaseous working fluid when the thermoacoustic device is in the non-operating mode;

the main chamber including a first oscillating member, the first oscillating member being operable when the thermoacoustic device is in the operating mode to oscillate such that pressure in the multiplier chamber is oscillated between a peak pressure greater than the equilibrium pressure and a minimum pressure less than the equilibrium pressure, a main pressure amplitude being defined as one half of the difference between the peak pressure and the minimum pressure in the main chamber;

the secondary multiplier chamber including a second oscillating member, the second oscillating member being operable when the thermoacoustic device is in the operating mode to oscillate such that the pressure in the multiplier chamber is oscillated between a peak pressure greater than the equilibrium pressure and a minimum pressure less than the equilibrium pressure, a multiplier pressure amplitude being defined as one half of the difference between the peak pressure and the minimum pressure in the multiplier chamber;

wherein the first and second oscillating members oscillate at substantially the same frequency and such that the pressure oscillations in the main chamber and the multiplier chamber are substantially in phase with each other; and

the multiplier pressure amplitude is less than the main pressure amplitude.

55. The thermoacoustic device according to claim 54, wherein the multiplier pressure amplitude is at least 2% less than the main pressure amplitude.

56. The thermoacoustic device according to claim 54, wherein the multiplier pressure amplitude is at least 4% less than the main pressure amplitude.

57. The thermoacoustic device according to claim 1, wherein the multiplier pressure amplitude is at least 6% less than the main pressure amplitude.

58. The thermoacoustic device according to claim 54, further comprising a motor connected to the first oscillating member, the motor being operable to sinusoidally oscillate the first oscillating member such that the thermoacoustic device operates as a heat pump.

59. The thermoacoustic device according to claim 54, further comprising an alternator connected to the first oscillating member, the thermoacoustic device operating as a heat driven engine.

60. The thermoacoustic device according to claim 54, wherein the multiplier chamber is disposed within the main chamber.